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DANN, DORFMAN, HERRELL & SKILLMAN
1601 MARKET STREET
SUITE 2400
PHILADELPHIA, PA 19103-2307

EXAMINER	
NOGUEROLA, ALEXANDER STEPHAN	
ART UNIT	**PAPER NUMBER**
1753	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/30/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/668,930	JACOBSON ET AL.	
	Examiner	Art Unit	
	ALEX NOGUEROLA	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *preliminary amendment of 01/19/2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *8-10,19,20,28-32 and 36-74* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *8-10,19,20, 28- 32, 36-38, 40-49,51-56,59-66,69-75* is/are rejected.

7)☒ Claim(s) *39,50,57,58,67 and 68* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9/23/2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. Claims 8-10, 36-38, and 29 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for "membranous material that is characterized by an ability to conduct charged particles or ions while inhibiting bulk material transport therethough", does not reasonably provide enablement for "membranous material that is characterized by an ability to conduct electrical current while inhibiting bulk material flow therethough." The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make or use the invention commensurate in scope with these claims.

The claims themselves strongly suggest that for claim 8 Applicant meant "membranous material that is characterized by an ability to conduct charged particles or ions while inhibiting bulk material transport therethough" instead of "membranous material that is characterized by an ability to conduct electrical current while inhibiting bulk material flow therethough" because several dependent claims require materials that are either inherently *not* electrically conductive or that are not usually thought of as conductive. For example, Claims 9 and 10 require polymeric gel and polyacrylamide

gel, respectively. No mention of "membranous material that is characterized by an ability to conduct electrical current while inhibiting bulk material flow therethough" has been found in the specification.

Additionally, it is not clear from the disclosure how the "membranous material that is characterized by an ability to conduct electrical current while inhibiting bulk material flow therethough" is to be part of the device or how it is to be used. Is electrical current actually to flow across this membranous material? If yes, then is a separate means for applying electrical potential to be connected across the material or will the flow of electrically result from the claimed means for applying an electrical potential between the channels? If the latter, how will electricity flow through the solution and through the membranous material?

2. Note that dependent claims will have the deficiencies of base and intervening claims.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 8, 20, 30, 31, 40, 46, 47, 49, 51, 53, 55, 56, 59, 61, 63, 65, 66, 69, 71, and 73 are rejected under 35 U.S.C. 102(e) as being anticipated by Dubrow et al. (US 5,976,336) ("Dubrow").

Addressing claim 8, Dubrow discloses a method of controllably moving material comprising the steps of

providing a microchannel device (col. 06:65-66) that includes a substrate having first (104), second (116), and third (102) channels disposed therein (Figure 1A), the first, second, and third channels communicating at a channel intersection (108 – note that "communicating" is broader than "meeting"), the second channel containing a membranous material ("sieving material", col. 12:12-24) that is characterized by an ability to conduct "electric current" (see the rejection under 35 U.S.C. 112, first paragraph, above) while inhibiting bulk material flow therethrough (note that Dubrow discloses that the membranous material shields the charged surfaces of the channel walls and so reduces electroosmotic flow); and

providing a flow of a first material from the first channel into the third channel by applying a first electrical potential to the first channel and a second electrical potential to the second channel through the membranous material (Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a

voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Addressing claim 20, Dubrow discloses a method for pumping a material through a channel comprising the steps of

providing a microchannel device (col. 06:65-66) that includes a substrate having first (104) and second (116) channels disposed therein (Figure 1A), the first and second channels being in fluid communication at a channel intersection (108 - note that "communicating" is broader than "meeting"), and containing a first fluidic material (col. 07:14-30);

providing a membranous material in the first channel ("sieving material", col. 12:12-24);

providing a third channel that is in fluid communication with the first and second channels at the channel intersection (102);

providing a second membranous material in the third channel ("sieving material", col. 12:12-24. Note that this claim does not require the second membranous material to be different from the first membranous material); and

inducing a hydraulic pressure in the second channel by applying an electrical potential between the first and third channels (note that although Dubrow discloses that the membranous materials will reduce electroosmotic flow (col. 12:12-20), it does not

state that it will be completely eliminated. Moreover, Applicant himself discloses using polyacrylamide as the membranous material (page 7, lines 20-21 and the last line page 16, bridging to page 17 of the specification)

Addressing claim 30, Dubrow discloses a device for the manipulation of liquid phase materials, comprising

a substrate (col. 06:65-66);

first (104), second (116) and third (102) channels formed on the substrate, the first, second, and third channels being in fluidic communication at a channel junction (108 – note that "communication" is broader than "meeting");

a membranous material disposed in the second channel ("sieving material", col. 12:12-24) that is characterized by an ability to conduct "electric current" (see the rejection under 35 U.S.C. 112, first paragraph, above) while inhibiting bulk material flow therethrough (note that Dubrow discloses that the membranous material shields the charged surfaces of the channel walls and so reduces electroosmotic flow);

a source of electrical potential adapted to be selectively connected to the first and second channels for inducing transport of a material in the first and third channels (implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Addressing claim 31, for the additional limitation of this claim note that Dubrow discloses that the substrate may be made of PDMS (col. 03:19-21), which Applicant has disclosed is gas permeable (page 21, lines 09-10 of applicant's specification which is only being relied upon to show a property of a material).

Addressing claims 40 and 69, for the additional limitation of this claim see col. 12:12-24, which discloses polymeric materials for the membranous material.

Addressing claim 46, Dubrow discloses a device for pumping material through a channel comprising

a substrate (col. 06:65-66 and Figure 1A);

first (104) and second (116) channels formed on the substrate (col. 06:65-66 and Figure 1A);

the first and second channels being in fluid communication at a first channel intersection (Figure 1A) (note that "communication" does not mean "meeting");

a first membranous material disposed in the first channel ("sieving material", col. 12:12-24); and

a source of electrical potential operatively connected to the first and second channels for inducing transport of a material in the second channel (implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is

accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Addressing claims 47, 51, 53, and 59, for the additional limitation of this claim see col. 12:12-24, which discloses polymeric materials for the membranous material.

Addressing claim 49, Dubrow discloses a device for the manipulation of liquid phase materials comprising

a substrate (col. 06:65-66 and Figure 1A);

first (104), second (116) and third (102) channels formed on the substrate (col. 06:65-66 and Figure 1A);

the first and second channels being in fluid communication at a first channel intersection (Figure 1A) (note that "communication" does not mean "meeting");

a first membranous material disposed in the first channel and a second membranous material disposed in the second channel ("sieving material", col. 12:12-24); and

a source of electrical potential operatively connected to the first and second channels for inducing transport of a material in the second channel (implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at the first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Addressing claim 55, Dubrow discloses a method of controllably moving material comprising the steps of

providing a microchannel device (col. 06:65-66) that includes a substrate having first (104), second (116), and third (102) channels disposed therein (Figure 1A), the first, second, and third channels communicating at a first channel intersection (108), the second and third channels being in fluid communication at a second channel intersection (where channel 166 meets channel 102, which intersection is also in fluid communication with channel 104), and containing a first fluidic material (col. 07:14-30);

providing a first membranous material in the first channel and a second membranous material in the second channel ("sieving material", col. 12:12-24); and inducing a hydraulic pressure in the third channel by applying an electrical potential between the first and second channels (Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first

sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Addressing claims 56, 61, 63, 66, 71, and 73, for the additional limitation of this claim note that the membranous material is present in all of the channels (col. 12:12-24).

Addressing claim 65, Dubrow discloses a device for the manipulation of liquid phase materials comprising

a substrate (col. 06:65-66 and Figure 1A);

first (104), second (116) and third (102) channels formed on the substrate (col. 06:65-66 and Figure 1A);

the first and third channels being in fluid communication at a first channel intersection (Figure 1A – where channels 104 and 102 intersect) ;

the second and third channels being in fluid communication at a second channel intersection (Figure 1A – where channels 116 and 102 intersect);

a first membranous material disposed in the first channel and a second membranous material disposed in the second channel ("sieving material", col. 12:12-24); and

a source of electrical potential operatively connected to the first and second channels for inducing transport of a material in the third channel (implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at the first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

5. Claims 19, 46, 47 are rejected under 35 U.S.C. 102(e) as being anticipated by Parce et al. (US 5,942,4430 ("Parce").

Addressing claim 19, Parce discloses a method for pumping a material through a channel comprising the steps of

providing a microchannel device (300 – Figure 3) that includes a substrate having a first (the bottom portion of any of channels 312-324, which is between horizontal channels 306 and 308 and which will herein after be referred to as 312b-324b) and second (308) channels disposed therein (Figure 3), the first and second channels being in fluid communication at a channel intersection (note intersections of 312b-324b with 308 in Figure 3) and containing a first fluidic material (col. 16:42-58);

providing a membranous material (344) in the first channel (col. 17:16-24); and

inducing a hydraulic pressure in the second channel by applying an electrical potential between the first and second channels (Figures 4C-F and col. 17:24-54 and col. 12:44 – col. 13:02).

Addressing claim 46, Parce discloses a device for pumping a material through a channel comprising

a substrate (300 – Figure 3);

first (the bottom portion of any of channels 312-324, which is between horizontal channels 306 and 308 and which will herein after be referred to as 312b-324b) and second (308) channels formed on the substrate (Figure 3);

the first and second channels being in fluid communication at a first channel intersection (Figure 3);

a first membranous material (344) disposed in the first channel (col. 17:16-24); and

a source of electrical potential operatively connected to the first and second channels for inducing transport of a material in the second channel (Figures 3 and 4A-F and col. 17:24-54 and col. 12:44 – col. 13:02).

Addressing claim 47, for the additional limitation of this claim see col. 17:16-24.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dubrow et al. (US 5,976,336) ("Dubrow") in view of Dolnik et al. (US 6,074,542) ("Dolnik").

Dubrow discloses a method of controllably moving material comprising the steps of

providing a microchannel device (col. 06:65-66) that includes a substrate having first (104), second (116), and third (102) channels disposed therein (Figure 1A), the first, second, and third channels communicating at a channel intersection (108), the second channel containing a membranous material ("sieving material", col. 12:12-24) that is characterized by an ability to conduct "electric current" (see the rejection under 35 U.S.C. 112, first paragraph, above) while inhibiting material flow therethrough (note that Dubrow discloses that the membranous material shields the charged surface s of the channel walls and so reduce electroosmotic flow); and

providing a flow of a first material from the first channel into the third channel by applying a first electrical potential to the first channel and a second electrical potential to the second channel through the membranous material (Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow discloses having the membranous material made of a polymeric

materiel, such as polyacrylamide (col. 12:12-24); however, the polyacylamide is in the form of linear strands and not in the form of a gel.

Dolnik discloses "... a method and apparatus utilizing a capillary coating of linear and *crosslinked* polymers ad copolymers of acrylamidomonomers or *methacrylamides* bearing two hydroxyethyl residues. The method and apparatus employ this coating to maintain coating integrity and suppress electroosmotic flow under basic conditions in capillary electrophoresis. [emphasis added]" See the abstract. The choice of which capillary coating to use from known coatings for the same purposes (such as between Dubrow's linear polyacrylamide or Dolnik's meathacrylamide polymers) is just a matter of optimization for the intended sample. Dolnik's polymers have the advantage of being stable over a wide pH range including alkaline pH levels and being stable for hundreds of electrophoretic runs. See col. 03:56-67.

10. Claims 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Parce et al. (US 5,942,4430 ("Parce").

Addressing claim 28, Parce discloses a device for the manipulation of liquid phase materials, comprising

a substrate (300 – Figure 3); and

first (the bottom portion of any of channels 312-324, which is between horizontal channels 306 and 308 and which will herein after be referred to as 312b-324b) and second (308) channels formed on the substrate (Figure 3).

Parce does not show in Figure 3 a reservoir in fluid communication with the first and second channels. One with ordinary skill in the art at the time of the invention would recognize that Figure 3 only shows a partial view of the microfluidic network and in particular sample that enters the sample channel 304 has a source. It would have been obvious to one with ordinary skill in the art at the time of the invention to provide a reservoir at the inlet end of channel 304 (which would be in fluid communication with the first and second channels) because Parce discloses that in systems similar to hose in Figures 3 and 4A-F, "Typically, such systems will incorporate electrodes within reservoirs disposed at the termini of the various transverse channels to control fluid flow through the device" (col. 17:30-33) and for the basic embodiment shown in Figure 1 in which no reservoir is shown at the inlet end of the sample channel 112 "... the sample channel **112** may be individually fluidly connected to a plurality of separate reservoirs via separate channels. The separate reservoirs each contain a separate test compound with additional reservoirs being provided for appropriate spacer compounds" (col. 09:56-60).

Addressing claim 29, for the additional limitation of this claim note membranous material (344) in the first channel (col. 17:16-24).

11. Claims 32 and 42-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dubrow et al. (US 5,976,336) ("Dubrow") in view of Pace (US 4,908,112).

Addressing claim 32, Dubrow discloses a device for the manipulation of liquid phase materials, comprising

a substrate (col. 06:65-66);

first (104), second (116) and third (102) channels formed on the substrate, the first, second, and third channels being in fluidic communication at a channel junction (108 – note that "communication" is broader than "meeting");

a membranous material disposed in the second channel ("sieving material", col. 12:12-24) that is characterized by an ability to conduct "electric current" (see the rejection under 35 U.S.C. 112, first paragraph, above) while inhibiting bulk material flow therethrough (note that Dubrow discloses that the membranous material shields the charged surfaces of the channel walls and so reduces electroosmotic flow);

a source of electrical potential adapted to be selectively connected to the first and second channels for inducing transport of a material in the first and third channels (implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow also discloses that the substrate may be made of PDMS (col. 03:19-21), which Applicant has disclosed is gas permeable (page 21, lines 09-10 of Applicant's specification which is only being relied upon to show a property of a material).

Dubrow does not describe the coverplate.

Pace discloses a microfluidic device comprising a microfluidic network in a substrate covered with a glass coverplate, which is nonporous and electrically insulating, having a metallic electrode formed on the underside of the plate. See the abstract; Figures 1 and 3; and col. 06:56-63. It would have been obvious to one with ordinary skill in the art at the time of the invention to use a glass coverplate as taught by Pace in the invention of Dubrow because this protects the fluid in the channels from contamination while allowing detection and preventing fluid leakage. See col. 06:46-55 and Figure 5. It would have been obvious to one with ordinary skill in the art at the time of the invention to provide electrodes along the channel walls as taught by Pace it the invention of Dubrow because as taught by Pace this will avoid the high voltages needed when only electrodes at the channel ends in the reservoirs are used, which produces unwanted electrolysis products and a large amount of heat. See col. 02:35-58 and col. 03:52-62. As for the metallic electrode formed on the underside of the plate, it would have been obvious to one with ordinary skill in the art at the time of the invention to provide this element because this will allow maximal contact of the electroosmotic electrodes with the fluids therein. See col. 06:56-63.

Addressing claim 42, Dubrow discloses a method comprising the steps of

providing a microchannel device that includes a substrate having first (104), and second (116 or 102) channels disposed therein (col. 06:65-66 and Figure 1A);

providing a reservoir (110) in fluid communication with the first and second channels (Figure 1A); and

inducing electrokinetic transport of a fluid material from the reservoir into the second channel by applying an electrical potential across the first and second channels (Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow does not mention minimizing electrochemically generated species in a sample material.

Pace discloses a microfluidic device comprising a microfluidic network in a substrate covered with electrodes along the walls of the channels. See the abstract and Figures 1 and 2. It would have been obvious to one with ordinary skill in the art at the time of the invention to provide electrodes along the walls of the channels as taught by Pace in the invention of Dubrow because as taught by Pace this will avoid the high voltages needed when only electrodes at the channel ends in the reservoirs are used, which produces unwanted electrolysis products and a large amount of heat. See col. 02:35-58 and col. 03:52-62.

Addressing claim 43, Duborw also has a membranous material disposed in the first channel ("sieving material", col. 12:12-24) that is characterized by an ability to conduct "electric current" (see the rejection under 35 U.S.C. 112, first paragraph, above) while inhibiting bulk material flow therethrough (note that Dubrow discloses that the membranous material shields the charged surfaces of the channel walls and so reduces electroosmotic flow).

Addressing claim 44, for the additional limitation of this claim see col. 12:12-24, which discloses polymeric materials for the membranous material.

Addressing claim 45, Dubrow does not mention "providing the membranous material as a channel having a transverse dimension that is similar to the thickness of the electrical double layer." However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electroosmotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

12. Claims 37, 41, 48, 52, 54, 60, 62, 64, 70, 72, and 75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dubrow et al. (US 5,976,336) ("Dubrow").

Addressing claim 37, Dubrow discloses a method of controllably moving material comprising the steps of

providing a microchannel device (col. 06:65-66) that includes a substrate having first (104), second (116), and third (102) channels disposed therein (Figure 1A), the first, second, and third channels communicating at a channel intersection (108), the second channel containing a membranous material ("sieving material", col. 12:12-24) that is characterized by an ability to conduct "electric current" (see the rejection under 35 U.S.C. 112, first paragraph, above) while inhibiting material flow therethrough (note that Dubrow discloses that the membranous material shields the charged surface s of the channel walls and so reduce electroosmotic flow); and

providing a flow of a first material from the first channel into the third channel by applying a first electrical potential to the first channel and a second electrical potential to the second channel through the membranous material (Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow discloses having the membranous material made of a polymeric materiel, such as polyacrylamide (col. 12:12-24); however, the polyacrylamide is in the form of linear strands and not in the form of a gel.

Dubrow does not mention "providing the membranous material as a channel having a transverse dimension that is similar to the thickness of the electrical double layer." However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electrosomotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

Addressing claim 41, Dubrow discloses a device for the manipulation of liquid phase materials, comprising

a substrate (col. 06:65-66);

first (104), second (116) and third (102) channels formed on the substrate, the first, second, and third channels being in fluidic communication at a channel junction (108 – note that "communication" is broader than "meeting");

a membranous material disposed in the second channel ("sieving material", col. 12:12-24) that is characterized by an ability to conduct "electric current" (see the rejection under 35 U.S.C. 112, first paragraph, above) while inhibiting bulk material flow therethrough (note that Dubrow discloses that the membranous material shields the charged surfaces of the channel walls and so reduces electroosmotic flow);

a source of electrical potential adapted to be selectively connected to the first and second channels for inducing transport of a material in the first and third channels

(implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow does not mention "providing the membranous material as a channel having a transverse dimension that is similar to the thickness of the electrical double layer." However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electroosmotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

Addressing claim 48, Dubrow discloses a device for pumping material through a channel comprising

a substrate (col. 06:65-66 and Figure 1A);

first (104) and second (116) channels formed on the substrate (col. 06:65-66 and Figure 1A);

the first and second channels being in fluid communication at a first channel intersection (Figure 1A) (note that "communication" does not mean "meeting");

a first membranous material disposed in the first channel ("sieving material", col. 12:12-24); and

a source of electrical potential operatively connected to eh first and second channels for inducing transport of a material in the second channel (implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow does not mention having the first membranous material comprise a cannel with a transverse dimension commensurate with the electrical double layer. However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electroosmotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

Addressing claim 52, Dubrow discloses a device for the manipulation of liquid phase materials comprising

a substrate (col. 06:65-66 and Figure 1A);

first (104), second (116) and third (102) channels formed on the substrate

(col. 06:65-66 and Figure 1A);

the first and second channels being in fluid communication at a first channel intersection (Figure 1A) (note that "communication" does not mean "meeting");

a first membranous material disposed in the first channel and a second membranous material disposed in the second channel ("sieving material", col. 12:12-24); and

a source of electrical potential operatively connected to the first and second channels for inducing transport of a material in the second channel (implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow does not mention having the first membranous material comprise a channel having a transverse dimension that is similar to the thickness of the electrical double layer. However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electroosmotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

Addressing claim 54, Dubrow discloses a device for the manipulation of liquid phase materials comprising

a substrate (col. 06:65-66 and Figure 1A);

first (104), second (116) and third (102) channels formed on the substrate (col. 06:65-66 and Figure 1A);

the first and second channels being in fluid communication at a first channel intersection (Figure 1A) (note that "communication" does not mean "meeting");

a first membranous material disposed in the first channel and a second membranous material disposed in the second channel ("sieving material", col. 12:12-24); and

a source of electrical potential operatively connected to the first and second channels for inducing transport of a material in the second channel (implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow does not mention having the first membranous material comprise a channel having a transverse dimension that is similar to the thickness of the electrical double layer. However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electroosmotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow

is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

Addressing claim 60, Dubrow discloses a method of controllably moving material comprising the steps of

providing a microchannel device (col. 06:65-66) that includes a substrate having first (104), second (116), and third (102) channels disposed therein (Figure 1A), the first, second, and third channels communicating at a first channel intersection (108), the second and third channels being in fluid communication at a second channel intersection (where channel 166 meets channel 102, which intersection is also in fluid communication with channel 104), and containing a first fluidic material (col. 07:14-30);

providing a first membranous material in the first channel and a second membranous material in the second channel ("sieving material", col. 12:12-24); and inducing a hydraulic pressure in the third channel by applying an electrical potential between the first and second channels (Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow does not mention having the first membranous material comprise a channel having a transverse dimension that is similar to the thickness of the electrical

double layer. However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electroosmotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

Addressing claim 62, Dubrow discloses a method of controllably moving material comprising the steps of

providing a microchannel device (col. 06:65-66) that includes a substrate having first (104), second (116), and third (102) channels disposed therein (Figure 1A), the first, second, and third channels communicating at a first channel intersection (108), the second and third channels being in fluid communication at a second channel intersection (where channel 166 meets channel 102, which intersection is also in fluid communication with channel 104), and containing a first fluidic material (col. 07:14-30);

providing a first membranous material in the first channel and a second membranous material in the second channel ("sieving material", col. 12:12-24); and inducing a hydraulic pressure in the third channel by applying an electrical potential between the first and second channels (Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow does not mention having the second membranous material comprise a second channel having a transverse dimension that is similar to the thickness of the electrical double layer. However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electroosmotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

Addressing claim 64, Dubrow discloses a method of controllably moving material comprising the steps of

providing a microchannel device (col. 06:65-66) that includes a substrate having first (104), second (116), and third (102) channels disposed therein (Figure 1A), the first, second, and third channels communicating at a first channel intersection (108), the second and third channels being in fluid communication at a second channel intersection (where channel 166 meets channel 102, which intersection is also in fluid communication with channel 104), and containing a first fluidic material (col. 07:14-30);

providing a first membranous material in the first channel and a second membranous material in the second channel ("sieving material", col. 12:12-24); and inducing a hydraulic pressure in the third channel by applying an electrical potential between the first and second channels (Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at he first

sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow does not mention having the third membranous material comprise a third channel having a transverse dimension that is similar to the thickness of the electrical double layer. However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electroosmotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

Addressing claim 70, Dubrow discloses a device for the manipulation of liquid phase materials comprising

a substrate (col. 06:65-66 and Figure 1A);

first (104), second (116) and third (102) channels formed on the substrate (col. 06:65-66 and Figure 1A);

the first and third channels being in fluid communication at a first channel intersection (Figure 1A – where channels 104 and 102 intersect);

the second and third channels being in fluid communication at a second channel intersection (Figure 1A – where channels 116 and 102 intersect);

a first membranous material disposed in the first channel and a second membranous material disposed in the second channel ("sieving material", col. 12:12-24); and

a source of electrical potential operatively connected to the first and second channels for inducing transport of a material in the third channel (implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at the first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow does not mention having the first membranous material comprise a channel having a transverse dimension that is similar to the thickness of the electrical double layer. However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electroosmotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

Addressing claim 72, Dubrow discloses a device for the manipulation of liquid phase materials comprising

a substrate (col. 06:65-66 and Figure 1A);

first (104), second (116) and third (102) channels formed on the substrate

(col. 06:65-66 and Figure 1A);

the first and third channels being in fluid communication at a first channel intersection (Figure 1A – where channels 104 and 102 intersect);

the second and third channels being in fluid communication at a second channel intersection (Figure 1A – where channels 116 and 102 intersect);

a first membranous material disposed in the first channel and a second membranous material disposed in the second channel ("sieving material", col. 12:12-24); and

a source of electrical potential operatively connected to the first and second channels for inducing transport of a material in the third channel (implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at the first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow does not mention having the second membranous material comprise a channel having a transverse dimension that is similar to the thickness of the electrical double layer. However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electroosmotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

Addressing claim 74, Dubrow discloses a device for the manipulation of liquid phase materials comprising

a substrate (col. 06:65-66 and Figure 1A);

first (104), second (116) and third (102) channels formed on the substrate (col. 06:65-66 and Figure 1A);

the first and third channels being in fluid communication at a first channel intersection (Figure 1A – where channels 104 and 102 intersect);

the second and third channels being in fluid communication at a second channel intersection (Figure 1A – where channels 116 and 102 intersect);

a first membranous material disposed in the first channel and a second membranous material disposed in the second channel ("sieving material", col. 12:12-24); and

a source of electrical potential operatively connected to the first and second channels for inducing transport of a material in the third channel (implied by Figure 1B and col. 07:14-25 – in particular, "... this [drawing sample into channel 102] is accomplished by applying a voltage at the first sample reservoir **110** and the second load/waste reservoir **120**, to achieve material movement along the path of current flow.").

Dubrow does not mention having the third membranous material comprise a channel having a transverse dimension that is similar to the thickness of the electrical

double layer. However, it would have been obvious to one with ordinary skill in the art at the time of the invention to do so because electroosmotic flow is caused by a double layer formed at the channel wall and a purpose of the membranous material in Dubrow is to shield the charged surfaces of the these walls, thereby reducing electroosmotic flow. See col. 12:15-24.

Specification

13. The disclosure is objected to because of the following informalities: there are a number of inconsistencies in the reference labels used to refer to elements in the figures. For example, "10b" inline 26 on page 9 of the specification should be -- 20 B --. Likewise "10b" in line 2 on page 10 should be -- 20 B --. "5a" in line 23 on page 10 should be -- 25A --. There may be more discrepancies. Applicants are requested to check the references to figure elements.

Appropriate correction is required.

Allowable Subject Matter

14. Claims 39, 50, 57, 58, 67, and 68 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

15. The following is a statement of reasons for the indication of allowable subject matter:

a) Claims 39, 50, 57, 58, 67, and 68: Claims 39 and 50 each require the step of "providing electroosmotic flow in the first membranous material that is greater than electroosmotic flow in the second membranous material." Claim 57 requires "... the step of providing electroosmotic flow in the third membranous material that is greater than electroosmotic flow in the first membranous material." Claim 58 requires "... the step of providing electroosmotic flow in the first membranous material that is greater than electroosmotic flow in the second membranous material." Claim 67 requires the first and third membranous materials to be selected to provide electroosmotic flow in the third membranous material that is greater than electroosmotic flow in the first membrane material. Claim 68 requires the first and second membranous materials to be selected to provide

electroosmotic flow in the first membranous material that is greater than electroosmotic flow in the second membrane material.

Since in Dubrow there is no suggestion of having any of the buffer, membranous material, and the electrical field different in the regions of the first, second, and third membranous materials, the electroosmotic flow in the first membrane would be expected to be similar to the electroosmotic flow in the second membrane and the third membrane.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALEX NOGUEROLA whose telephone number is (571) 272-1343. The examiner can normally be reached on M-F 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, NAM NGUYEN can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Alex Noguerola

Alex Noguerola
Primary Examiner
AU 1753
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